From trends in commodities and manufactures to country terms of trade

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Abstract. The debate about the Prebisch-Singer thesis has focussed on *primary commodities* with some extensions to manufactures. As we think that the link between the terms of trade and long-run development, growth and convergence is the ability of exports to enhance investment through importing capital goods we analyse trends in *country* terms-of-trade. We use two data sets. We find that for the poor countries the terms of trade of goods and services are falling at a rate that is less negative than for net-barter terms of trade and those found earlier for primary commodities.

Key words: Prebisch-Singer thesis; country terms-of-trade; long-run development.
JEL codes: B23; F43; O19.

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UNU-MERIT Working Papers intend to disseminate preliminary results of research carried out at the Centre to stimulate discussion on the issues raised.

[1] I have benefited from communication with Alexis Habiyaremye, Huub Meijers, Rameshwar Tandon, Bart Verspagen and Adriaan van Zon. The Journal of Economic Literature has now 188 entries regarding 'Prebisch' and many more under 'terms of trade'. We apologize to all who go unmentioned in spite of their contributions. But trying to discuss all would make sure that this paper would never be finished.

Introduction

Prebisch and Singer found a fall in the prices of developing countries' primary commodities relative to those of British manufactured goods. From their work three branches of literature emerged. First, a statistical debate did arise in regard to the question whether or not developing country terms of trade are really falling. Second, a series of theoretical models were developed in which terms of trade changes over time could be explained. Third, the policy consequences of falling terms of trade were discussed, mainly the question whether a fall in the terms of trade should lead to industrialization policies. Our paper tries to contribute to the first branch of literature.

There are two widespread versions of the Prebisch-Singer thesis (Singer 1999). The narrow one is a statistical view on the hypothesis of a trend in the relation between primary commodities and manufactured goods, also called Prebisch-Singer hypothesis (PSH). The broader one is interested in developing countries' terms of trade because they are related to exports and exports are related to growth and welfare, and questions like convergence versus divergence, called Prebisch-Singer thesis (PST). The special aspect here is that trade and growth are linked through developing countries' imports of capital goods (Prebisch 1950; 1962, p.2). In this broader perspective the commodity terms of trade were the most relevant indicator around 1950, especially as long as other data were not available.

The empirical literature on the long-run development in the terms of trade, once put into this broader perspective, indicates that what is needed are not only *commodity* terms of trade or those of *manufactures*, but also terms of trade analyses on the *country* level. From a theoretical point of view, what matters for growth is investment; and capital goods of developing countries are mainly imported. Exports are required to pay for imported capital goods. But export growth depends on the terms of trade (see the application of the model by Bardhan and Lewis 1970 to the Prebisch-Singer thesis in Ziesemer 1995). Especially if the empirical problem once was in the commodity terms of trade, the more or less strong diversification of the economies then may have mitigated the problem[2] unless developing countries specialize also on industry goods and services with low income and price elasticities. Therefore we look at the country terms of trade in this chapter, for developed and developing countries. We are therefore not interested in commodities (the traditional approach) or in manufactures or their cointegration in this paper. Bleaney and Greenaway (1993) have shown that commodity price changes of 1% induce a term of trade change of only 0.3%. Lutz (1999a) finds a higher value. But even this aspect of the terms of trade debate is not uncontroversial. Aggregate commodity indices and country-level terms of trade are found to be unrelated by Cashin and Pattillo (2006) for Sub-Saharan Africa. These papers do not provide results for trends in country terms of trade though. Bidarkota and Crucini (2000) report trends in country terms of trade, which are negative throughout but insignificantly so. They group countries according to volatility in terms of trade, not income or poverty. Ram (2004) looked at net barter terms of trade at the country level and found that 16 of 26 countries investigated had significantly negative trends (5 others had insignificantly negative trends). We will look at a larger set of countries and group countries according to their per capita income. We are interested in the long-term average trend, no matter whether it occurs in the form of trends shifting up and down, comes in a few steps, swings, cycles or other forms. Supply (factor accumulation and technical progress) and demand forces (and the implied income and price elasticities of export demand) are assumed to determine these developments. Many of these

[2] Sarkar and Singer (1991) broadened the literature to include the analysis of manufactures.

developments (including speculation and buffer stocks) behind the terms of trade may take forms other than smooth trends of course. But what matters is not mainly the form but how countries are affected. Refinements are interesting but not the issue of this paper.

The Model

The long-run trend is obtained from a regression of the natural logarithm of the terms of trade, *p*, on a time trend. Straightforward additional regressors from the time-series literature are one or more lagged dependent variables. They also help avoiding serial correlation biases. We write this basic model per observation for country *i* at time *t* as follows.

$$log\ p_{it} = c_i + \gamma_i log\ p_{i,t-1} + \beta_i\, t + u_{it} \qquad (1)$$

Taking first differences (making the lagged version of this equation and subtracting it from the equation above) and expected values it yields:

$$d(log(p_{it})) = \gamma_i d(log(p_{i,t-1})) + \beta_i \qquad (2)$$

If $b < 1$ this equation is stable in growth rates. The long run growth rate then is:[3]

$$d(log(p_i)) = \beta_i/(1-\gamma_i) \qquad (3)$$

Ram (2004) uses a special case of this model where $\gamma_i = 0$. Without lagged dependent variable one might run into an omitted variable bias, because lagged dependent variables tend to be highly significant. Moreover, the use of lagged dependent variables reduces serial correlation and the bias possibly caused by it.

When several lagged dependent variables are significant, stability can be analyzed most simply by way of simulation.

Data and econometric method

We follow the Worldbank classification for countries: low income (per capita income (GNI) of $975 or less in 2008), lower-middle income ($976-3855), upper-middle income ($3856-11905), high-income-non-OECD and high-income OECD (above $11906). The data are taken from the World Development Indicators (Worldbank 2009).[4]

We define the terms of trade in the first instance as exports as capacity to import (ecm) divided by exports (ex), both for trade in goods and services and measured in constant local currency units. The data are available from 1960 to 2008, with some non-available observations of course. But in principle we have 49 observations per country.

First, we run a fixed effects estimate. For our model this means that we impose a constraint, that the coefficients are identical for all countries in a sample except for the intercept. The constraint imposed on the model therefore is $\beta = \beta_i$, $\gamma = \gamma_i$. With lagged dependent variables as in our model, fixed effects estimates of the coefficient of the lagged dependent variable are biased. The bias has an order of magnitude of *1/T*, but the estimate is consistent. As a general rule, with more than thirty observations in the time dimension the bias is low enough to use the fixed effects method (see Judson and Owen 1999 and Baltagi 2008, ch.8).

[3] Bleaney and Greenaway (1993) discuss this model at greater length with all its possible outcomes.

[4] We found similar results using the classification of 2008, which differs quite a bit from that of 2009.

Second, we run the regression for all countries not only with a fixed effect but also with country-specific time trends. The only constraint then is the one for a common coefficient of the lagged dependent variable(s), $\gamma = \gamma_i$.
Third, we will relax this latter constraint also, and estimate a system of equations. The contemporaneous residuals of the countries may be correlated. Therefore we will use the SUR method (seemingly unrelated regression).

We also look at the net barter terms of trade as found in the World Development Indicators, which is the ratio of the export and the import price indices for goods that go through the customs. As services are excluded from these data Ram (2004) speaks of 'commodity (net barter) term of trade'. Unfortunately, these series have less than 30 observations. Therefore we should use the system GMM method (see Baltagi 2008, Roodman 2009 and Soto 2009)[5] if fixed effects are not redundant. When using GMM we could not get rid of second-order serial correlation and got mostly implausibly high or low values of the Sargan statistic. Both point to invalid instruments. Probably this is due to the simplicity of our approach and therefore GMM cannot be used here. We use EGLS (estimated generalized least squares) in order to take into account the cross-section heterogeneity. When fixed effects are not redundant this leads to an expected bias in the order of magnitude *1/T* for the lagged dependent variable, which is 1/23 in our case for low income countries. Finally, also for the net-barter terms of trade we will relax all constraints and estimate a system using the SUR method.

Table 1 OVER HERE

Results

Tables 1 and 2 show results using the data of 'exports as capacity to import divided by exports' taken in natural logarithms and abbreviated as log(ecm/ex). We use two lagged dependent variables. Table 1 shows the value of the coefficients and the marginal significance levels (p-values). Only the low-income countries have a significant trend, which is negative. The long-run trend, *β/(1-sum of coefficients of the lagged dependent variables)*, is also shown. For the low-income countries it is -0.42%. This value is smaller than the value for commodity terms of trade of -0.6% of Ardeni and Wright (1992) and Sapsford and Balasubramanyam (1994) and almost equal to the value of –0.44% found by Lutz (1999b). It is also in the range of the values for commodities obtained by Bleaney and Greenaway (1993) for several periods ending in 1991 and in the range of the literature surveyed by Lutz (1999b). The negative trend is stronger in the earlier periods than in later ones in our analysis (not shown), as we can see from starting the regression successively ten years later. There are neither common nor individual unit roots in the poor country sample.

Table 2 OVER HERE

[5] The econometric reasoning leading to the choice of the system GMM estimator is as follows (see Baltagi 2008, ch.8). In the presence of lagged dependent variables ignoring non-redundant fixed effects may lead to a heterogeneity bias. The use of fixed effects leads to a bias for the coefficient of the lagged dependent variable of the order of magnitude of *1/T*, where *T* is the number of periods for which data are available. Taking first differences can remove this bias and leads to the Anderson-Hsiao estimator, which is inefficient though. The first-differences estimator by Arellano-Bond removes this inefficiency. However, it has a small sample bias. The system GMM estimator by Arellano-Bover turns out to be the best estimator according to Monte-Carlo studies by Blundell and Bond as well as Soto (2009).

Table 2 summarizes the results if countries have a common lagged dependent variable but individual time trends. Column 1 shows the number of countries with a significantly negative time trend. This is largest for the poorest countries; but in percentages of all countries in the respective groups, column 5, the high-income OECD has a larger share. The number of significantly positive trends in column 2 is lowest in low-income countries. Insignificant trends are most frequent in all groups except for high income OECD countries. When we relax the constraint of a common lagged dependent variable and estimate the system of equations (1) using the SUR method (not shown), the number of low income countries with significantly negative trends goes from 15 in Table 2 to 19.

Table 3 OVER HERE

For the net barter terms of trade the results from estimation with common coefficients on the lagged dependent variable are summarized in Table 3. The sign and significance for the long-run trend are the same as in Table 1 for the low-income countries and more negative and significant for lower-middle income countries. The numerical values may be biased though as we do have only observations for 23 periods for the poor countries. Another reason why the long-term trend is more negative may be that the net barter terms of trade are based only on commodities but not services, which are included in the data for export-as-capacity-to-import/exports used in Tables 1 and 2. When we start the regression only in 1992, the coefficient of the trend is almost the same, but the sum of the coefficients for the lagged dependent variables is smaller and therefore the long-term trend is smaller. Similarly, Ram (2004) found that the trends are more negative before the 1980s (estimating for 1970-1999). For commodities Bleaney and Greenaway (1993) found that the negative trend stems from the period 1980-1992. The stronger growth of African countries since 1990 or 1995 is often attributed to better prices received. All these results together point to the difficulty of separating trends and volatility, or may indicate that each decennium may have its own 'trend'. When dropping all constraints the SUR estimate (not shown) of a system of equations (1) with two lagged dependent variables has significantly negative signs for 17 of 26 low income countries.

Conclusion

Our interpretation of these results is that 11 of the twenty-seven high-income OECD countries are passing on more of technical change to their customer countries than they get as suggested by Kravis (1970), whereas the majority has no significantly falling terms of trade. Assuming that the low-income countries have hardly any technical progress, the fall in the terms of trade by about 0.4% according to Table 1 might be due to a lack of growth of export demand, which reduces the growth of imported investment goods as suggested by Prebisch (1950/1962, p.2). As three low income countries have significantly positive trends they probably have strong export demand growth relative to the technical change they pass on to their customer countries.

There are two common counterarguments in regard to the falling terms of trade results. The first refers to transport costs. As import prices contain cost, insurance and freight (CIF) but export prices are 'free on board' (fob) prices, import price indices may have a lower growth rate than without transport costs at times of strong technical change in transport.[6] With a higher growth rate in import prices the fall in the terms of trade would decrease the rate of growth of the terms of trade even more. By implication the argument can only be interesting in regard to

[6] Data on c.i.f./f.o.b. factors are no longer published by the IMF.

relative terms of trade growth of developed and developing countries if this decrease is larger for developed than for developing countries. But we have no indication for this for the time under consideration. The second common argument is unmeasured changes in quality of goods. Nothing has been shown in regard to this issue and perhaps everything is possible. But it is hard to believe that relative prices would become constant through this. The forces of asymmetric technical change and income elasticities of export demand would still be in existence if quality were correctly taken into account. Therefore we think that our step from the analysis of trends in commodity terms of trade as initiated by Prebisch and Singer and manufactures as initiated by Sarkar and Singer (1991) to country terms of trade in this paper is an important one. When the term-of-trade are based on exports-as-capacity-to-import/exports both based on goods and services, the fall in the terms of trade is smaller than for net-barter-terms-of-trade but does not vanish.

We have given only an intuitive interpretation of the results. More elaborate theorizing is possible but beyond the scope of this paper. A good model must be able to explain both of these types of trends and should take into account elements that are included by relatively successful closed economy growth models – savings, investment, labour growth and technical change. The preferred elements to be added to a closed economy growth model are exports and imported capital goods as in the model of Bardhan and S.Lewis (1970) a variant of which has been estimated and tested recently by Mutz and Ziesemer (2008). This type of model has the property that investment and GDP per capita growth are both positively related to the terms of trade as found in the evidence of Bleaney and Greenaway (2001). They are good for both situations, times of falling and times of increasing terms of trade because they have stochastic terms in the production function and in the export demand function and therefore can deal with endogenous trends and volatility[7].

The results suggest that being richer makes the problem less severe. Therefore growth policies should be good to avoid the fall in the terms of trade, as far as it is related to the level of growth. Moreover, poor countries may have more favourable terms of trade development if they have a lower share of products with low income elasticities of demand. This is more likely the more countries are diversified. Diversification policies at each level of growth may be avoiding falling terms of trade as well. The list of variables enhancing diversification has a large overlap with the list of variables enhancing growth. Habiyaremye and Ziesemer (2006) show this for a cross-section of countries in Sub-Saharan Africa. In particular, infrastructure and education are helpful. Therefore it is tempting to speculate that the same variables will help stopping the terms of trade from falling. We leave this point for further research as some of the diversification indices are not available in panel form but only for one cross section. We hope to have shown though that the problem of falling terms of trade continues to exist for many countries.

[7] Volatility is emphasized by Bleaney and Greenaway (2001).

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Table 1

Common trend in panels of exports-as-capacity-to-import/exports with fixed effects and lagged dependent variables (a)

Income group	High OECD	High Non-OECD	Upper Middle	Lower Middle	Low
Constant	0.0020	0.0001	0.0063	0.0030	0.0125
(p-value)	(0.27)	(0.99)	(0.03)	(0.01)	(0.11)
coeff.lag.dep.(-1)	1.05	1.03	0.91	0.89	0.80
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
coeff.lag.dep.(-2)	-0.151	-0.140	-0.064	-0.034	0.049
(p-value)	(0.00)	(0.03)	(0.06)	(0.26)	(0.06)
Coeff. Trend	-0.00009	0.00026	-0.00004	-0.00003	-0.00064
(p-value)	(0.21)	(0.30)	(0.70)	(0.54)	(0.02)
long-run coeff (b)	-0.0009	0.0023	-0.0003	-0.0002	-0.0042
Adj.R^2	0.916	0.95	0.834	0.831	0.874
DW (c)	1.94	1.89	1.90	1.98	1.99
Number of countries	27	19	39	44	40
Total observations	1152	338	1110	1420	1238
Prob. fixed effects redundant (d)	0.77	0.00	0.14	0.04	0.00
Period	1962-2008	1962-2008	1962-2008	1962-2008	1962-2008

(a) Dependent variable: LOG(ECM/EX). Method: Fixed effects. Pooled EGLS(Cross-section weights); PCSE: Period SUR

(b) Coefficient of trend divided by (1- sum of coefficients of lagged dependent variables). This value is the stable growth rate to which the system converges.

(c) Durbin-Watson statistic. Although it is not the adequate statistic for rigorous tests under endogeneity, its size indicates that there can be no serious serial correlation bias. See Epple and McCallum 2006.

(d) F-statistic

Table 2 **Number of countries with individual trends in exports-as-capacity-to-import/exports (a)**

Group	*Signif. Neg.*	*Signif.pos.*	*Insign.*	*Total*	*% sign.neg*	*coeff. lag.dep.(b)*
High income OECD	11	8	8	27	0.41	0.84
High Income Non-OECD	1	2	16	19	0.05	-0.06
Upper Middle income	4	8	27	39	0.10	0.81
Lower Middle Income	11	7	26	44	0.25	0.76
Lower income	15	3	22	40	0.38	0.73

(a) Least squares with country-specific fixed effects and trends and common coefficient of the lagged dependent variable.
(b) Period SUR PCSE; p-val. is 0.0000 in all cases. For high income countries four lags are significant; for all other samples only one lag.

Table 3 **Trends in net-barter terms of trade (a)**

Income group	High OECD	High Non-OECD	Upper Middle	Lower Middle	Low
Constant	0.677	0.129	0.551	0.688	0.789
(p-value)	0.000	0.366	0.000	0.000	0.000
coeff.lag.dep.(-1)	1.064	0.981	0.870	0.854	0.908
(p-value)	0.000	0.000	0.000	0.000	0.000
coeff.lag.dep.(-2)	-0.322	-	-	-	-0.062
(p-value)	0.000	-	-	-	0.110
coeff.lag.dep.(-3)	0.192	-	-	-	-
(p-value)	0.001	-	-	-	-
coeff.lag.dep.(-4)	-0.078	-	-	-	-
(p-value)	0.037	-	-	-	-
Coeff. Trend	0.000	0.000	0.001	-0.001	-0.002
(p-value)	0.253	0.535	0.001	0.068	0.003
long-term trend	-0.002	-0.015	0.010	-0.004	-0.012
Adjusted R-squared	0.790	0.887	0.825	0.764	0.883
Durbin-Watson stat (c)	1.972	1.736	1.756	2.002	2.055
prob. fixed eff. redundant	0.874	0.000	0.824	0.226	0.019
Periods	1984-2008	1981-2007	1981-2007	1981-2007	1982-2007
Method: Panel Est.GLS	no ind. effects	fixed eff.	no ind. effects	no effects (b)	fixed eff.(d)
Panel corrected s.e.	Period SUR	Period SUR	Period SUR	Period SUR	Period SUR
Countries	22	13	27	34	32
Observations	491	167	611	734	693

(a) Dependent Variable: LOG(NBT)
(b) Signs and significance also hold with fixed effects.
(c) Durbin-Watson statistic. Although it is not the adequate statistic for rigorous tests under endogeneity, its size indicates that there can be no serious serial correlation bias. See Epple and McCallum 2006.
(d) When using first differences and time fixed effects, lagged dependent variables are insignificant and the growth rate is a negative constant of -0.009875.

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